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LEISHMANIASIS SURVEILLANCE IN THE SINAI WITH SPECIAL EMPHASIS
TO THE MULTINATIONAL FORCE AND OBSERVERS AND ASSOCIATED AREAS

By

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AND OBSERVERS AND ASSOCIATED AREAS**

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ABSTRACT

Leishmaniasis is a wide spread disease throughout many regions of Southwest Asia. Military personnel deployed into the Sinai as members of the Multinational Force and Observers (MFO) contingent are at risk from Cutaneous Leishmaniasis (CL). This disease is vectored by various anthropophilic sand fly species, of which at least nine have been reported in the Sinai region.

Sand flies were collected through various years and *Phlebotomus papatasi* accounts for greater than 96% of species collected. Seasonal distribution of sand flies was studied. Feral rodents are implicated as reservoir hosts for CL. *Gerbillus sp.* and *Meuones crassus* account for nearly 80% of those collected during the survey.

Survey results for the isolation of *Leishmania* parasites indicate that a small percentage of sand flies are infected, ranging from zero to 5.07%. No feral rodents were found to be infected during the most recent (1993-1995) collection period. Human cases were reported, varying in number over different years, with a slight resurgence in 1995. Cutaneous leishmaniasis continues to pose a risk to troops deployed into the region and efforts to prevent the disease should be given priority.

INTRODUCTION

Leishmaniasis is a wide spread disease throughout many regions of Southwest Asia. *Leishmania* species may cause infections which vary greatly in pathology depending on the species of parasite involved. Although not a new disease to the military, leishmaniasis gained a renewed prominence in military medicine with a new form, viscerotropic, seen in some military personnel serving in the Middle East during the Persian Gulf War. Cutaneous Leishmaniasis (CL) is a polymorphic disease of the skin caused by an infection of an intracellular protozoan and is the most common form of leishmaniasis in the Sinai.

Personnel deployed to the Sinai as members of the Multinational Force and Observers (MFO) contingent are at risk from cutaneous leishmaniasis. This group of peacekeepers resulted from a three-party protocol, signed in 1981 by the United States, Egypt and Israel, when the United Nations Security Council announced it could not provide a peacekeeping force as outlined in the Treaty of Peace signed 26 March 1979 by Egypt and Israel. The MFO is not part of a United Nations peacekeeping force and is not part of NATO. Nations providing support to the MFO in the Sinai during the period of this study include: Australia; Canada; Columbia; Fiji; Hungary; Norway; France; Italy; Netherlands; New Zealand; United Kingdom; Uruguay; and the United States.

LEISHMANIA DISTRIBUTION

In the Sinai region and surrounding areas of Egypt and Israel three species of *Leishmania* have been reported, viz., *Leishmania major*, *L. infantum* and *L. tropica*.¹ *Leishmania major* has been the only Old World species isolated from the Sinai from humans, animals or sand flies in NAMRU-3 studies commencing in 1982.

SAND FLY SPECIES

At least nine different anthropophilic sand fly species are

reported in the literature from the Sinai,^{1,2} six of which are potential or confirmed vectors of leishmaniasis.¹ The most prevalent species of sand fly collected from the MFO study areas was *P. papatasi*, accounting for more than 96% of the anthropophilic species collected (Table 1.). Other species collected include the possible vectors *P. alexandri*, *P. kazeruni* and *P. sergenti* and the reptile feeder, *Sergentomyia antennata*.

Phlebotomus kazeruni Theodor & Mesghali is a suspect vector of CL¹ and has been established in a laboratory colony at NAMRU-3. This is the first time this species has been successfully colonized in the laboratory. The initial specimens used to start this colony were collected from the Nawara Farm in the southern Sinai Peninsula near the Southern Camp of the MFO.¹ Studies to determine the ability of this species to vector CL are planned as well as studies of its bionomics.

RODENT SPECIES AND RESERVOIR HOSTS

Rodents have been implicated to be the natural zoonotic reservoir for *L. major* in the Sinai region. Desert gerbils and merinos are the reported reservoirs. *Gerbillus* species (*G. pyramidum floweri*, *G. gerbillus asyutensis*, *G. andersoni bonhotei*) and *Meriones crassus* account for nearly 80% of the feral rodents trapped in the study areas. The population composition of feral desert rodents trapped in MFO areas is shown in Table 2. The trapping of feral rodents and the use of sentinel animals (Syrian hamsters, *Mesocricetus auratus*) revealed an extremely low percentage of animals infected with *L. major*. Starting in 1989 until late fall 1995, *L. major* has been isolated from only one feral animal.¹ Fryauff et al. (1993)⁷ reported two sentinel hamsters developing multiple cutaneous lesions with *L. major* amastigotes present. All subsequent sentinel animals were shown to be negative for *Leishmania* infections.

Human Cases

Human cases have decreased in MFO personnel from the

inception of the study to the present. From October 1982 to July 1985, 113 members of the MFO were diagnosed as having CL.⁵ In a study conducted from 1989-91 by Fryauff et al. (1993)⁷, 21 human cases were reported with successful isolation in 17 of the cases. *Leishmania major* was identified in 15 of the cases and *L. panamensis* was isolated from the other two cases. The *L. panamensis* cases were from Columbian soldiers and represented recrudescence of infections acquired in Columbia prior to deployment with the MFO in the Sinai. During the period of 1993-94, no cases of CL were reported by the MFO medical contingent. However, one case of CL was diagnosed in an active duty U.S. Navy member who had worked in the study area. During 1995, a slight resurgence was seen in the MFO troops with 7 suspected cases of CL reported. Table 3 represents the number of cases of CL during the years mentioned. Historically the soldiers having the highest risk potential have been those who stationed at the outer checkpoints, primarily soldiers from Columbia, Fiji, Uruguay, and the United States of America. The Fijian soldiers have had the greatest number of cases of CL over the years. Even with the decrease in cases in deployed personnel, CL still poses a risk to deployed troops in the Sinai.

Although reported human cases of leishmaniasis in MFO personnel had declined to zero as of 1994, anecdotal reports from the local Bedouin community still suggested seasonally (May-July) high numbers of sand flies and reports of lesions believed to be CL. Additionally, one American civilian teenager who visited the Southern Sinai had a confirmed case of CL. On several occasions active lesions have been seen by NAMRU-3 personnel on Bedouins near MFO sites. These lesions appear to be CL and may further confirm that active transmission was taking place in the area.

The importation of New World leishmaniasis into the Sinai is a possibility, as seen with the two cases of *L. panamensis* reported from the Columbian soldiers. Currently studies at

NAMRU-3 are being undertaken to ascertain whether Old World sand flies are capable of vectoring New World leishmaniasis in the region.

SURVEILLANCE STRATEGIES

During the months of April through November 1993-95, NAMRU-3 personnel conducted surveillance at MFO sites. Sand flies were collected by CDC light traps, light traps with CO₂, and oiled paper sticky traps. Feral rodents were collected using baited Tomahawk and Sherman live traps. Sentinel hamsters were utilized at the MFO checkpoints to monitor possible transmission.

Seasonal occurrence of sand flies collected at the MFO checkpoints surveyed in 1993-95 is depicted in Figure 1 and Figure 2, these are the numbers of sand flies collected with light traps and on oiled paper sticky traps, respectively. A reduction of sand fly activity was seen at the outlying checkpoints during 1994. This reduction was most likely due to increased sanitation, elimination of rodent habitat and the routine use of insecticides within the outposts. Slight increases occurred again in 1995, possibly due to abnormal weather patterns in the area, as more rainfall was recorded in late 1994 than had been recorded in the past 80 years.

Live collected sand flies were sexed and the females stored in a DMSO solution, frozen in liquid nitrogen and returned to NAMRU-3 for examination to determine infection rates. Data from six different years 1989-91 and 1993-95 has been examined and is presented in Table 4. In 1989, 0.69% of the sand flies collected were found to be infected; in 1990, 0.93%; in 1991, none; in 1993, 1.38%; in 1994, 0.56%; and in 1995, 5.07%. The percentage of infected sand flies was variable and was possibly influenced by any number of reasons such as climatic changes or by unknown factors such as the movement of Bedouin camps which could alter the presence of feral rodent populations.

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LITERATURE CITED

1. World Health Organization. 1990. Control of the leishmaniasis. WHO Tech. Rep. Ser. 793.
2. Lane, R. P. 1986. The sand flies of Egypt (Diptera: Phlebotominae). Bull. Br. Mus. Nat. Hist. 52: 1-35.
3. El Sawaf, B. M., A. Shoukry, S. El Said, R. P. Lane, M. A. Kenawy, J. C. Beier, and S. Abdel Sattar. 1987. Sand fly species composition along an altitudinal transect in southern Sinai, Egypt. Ann. Parasitol. Hum. Comp. 62: 467-473.
4. Killick-Kendrick, R. 1990. Phlebotomine vectors of the leishmaniasis: a review. Med. Vet. Entomol. 4: 1-24.
5. Lewis, D. J. 1982. A taxonomic review of the genus *Phlebotomus* (Diptera: Psychodidae). Bull. Br. Mus. Nat. Hist. (Ent.). 45(2): 121-209.
6. Kanour, W. W., Jr. and H. A. Hanafi. 1995. A new Phlebotomine sand fly colony: Laboratory colonization of *Phlebotomus kazeruni* (Diptera: Phsycodidae). Submitted for publication to the J. Med. Entomol.
7. Fryauff, D. J., G. B. Modi, N. S. Mansour, R. D. Kreutzer, S. Soliman, and F. G. Youssef. 1993. Epidemiology of cutaneous leishmaniasis at a focus monitored by the Multinational Force and Observers in the Northeastern Sinai Desert of Egypt. Am. J. Trop. Med. Hyg. 49(5): 598-607.

Table 1. Sand Flies Collected in the MFO Areas, Sinai, Egypt, 1993-1995

| Species | Location of collection | % of collection |
|--|------------------------|-----------------|
| <i>Phlebotomus papatasi</i> | A | > 96 |
| <i>Phlebotomus alexandri</i> | N | < 1 |
| <i>Phlebotomus kazeruni</i> | S | < 1 |
| <i>Phlebotomus sergenti</i> | N | < 1 |
| <i>Sergentomyia antennata</i> ¹ | N | < 1 |

Location Key

A - All Areas
 N - Northern Sinai Only
 S - Southern Sinai Only

¹Reptile feeder

Table 2. Feral Rodents Collected in MFO Areas¹, Sinai, Egypt, 1994 - 1995

| Species | Common Name | % of Collection |
|---|--|-----------------|
| <i>Meriones crassus</i> Sundevall | Silky Jird <u>OR</u> Sundevall's Jird | 25.8% |
| <i>Gerbillus pyramidum floweri</i> (Thomas) | Greater Gerbil | 20.0% |
| <i>Gerbillus gerbillus asyutensis</i> Setzer | (N/A) | 17.1% |
| <i>Gerbillus andersoni bonhotei</i> (Thomas) | Anderson's Gerbil | 15.1% |
| <i>Gerbillus</i> sp. | | 1.7% |
| <i>Dipodillus dasyurus dasyurus</i> (Wagner) | Rough-tailed Dipodil | 15.4% |
| <i>Dipodillus</i> sp. | | 0.3% |
| <i>Mus musculus</i> Linnaeus | House Mouse | 3.5% |
| <i>Eliomys quercinus melanurus</i> (Linnaeus) | Garden Doormouse | 0.3% |
| <i>Acomys cahirinus</i> (Desmarest) | Egyptian Spiny Mouse | 0.3% |

¹All rodents were captured in Northern MFO areas.

Table 3. Number of Cases of Cutaneous Leishmaniasis Diagnosed in MFO Troops During Various Years, Sinai, Egypt

| Year(s) | Number of Cases |
|-------------|-------------------|
| 1982 - 1985 | 113 |
| 1989 - 1991 | 21 |
| 1992 | (No surveillance) |
| 1993 - 1994 | 1 ¹ |
| 1995 | 8 ² |

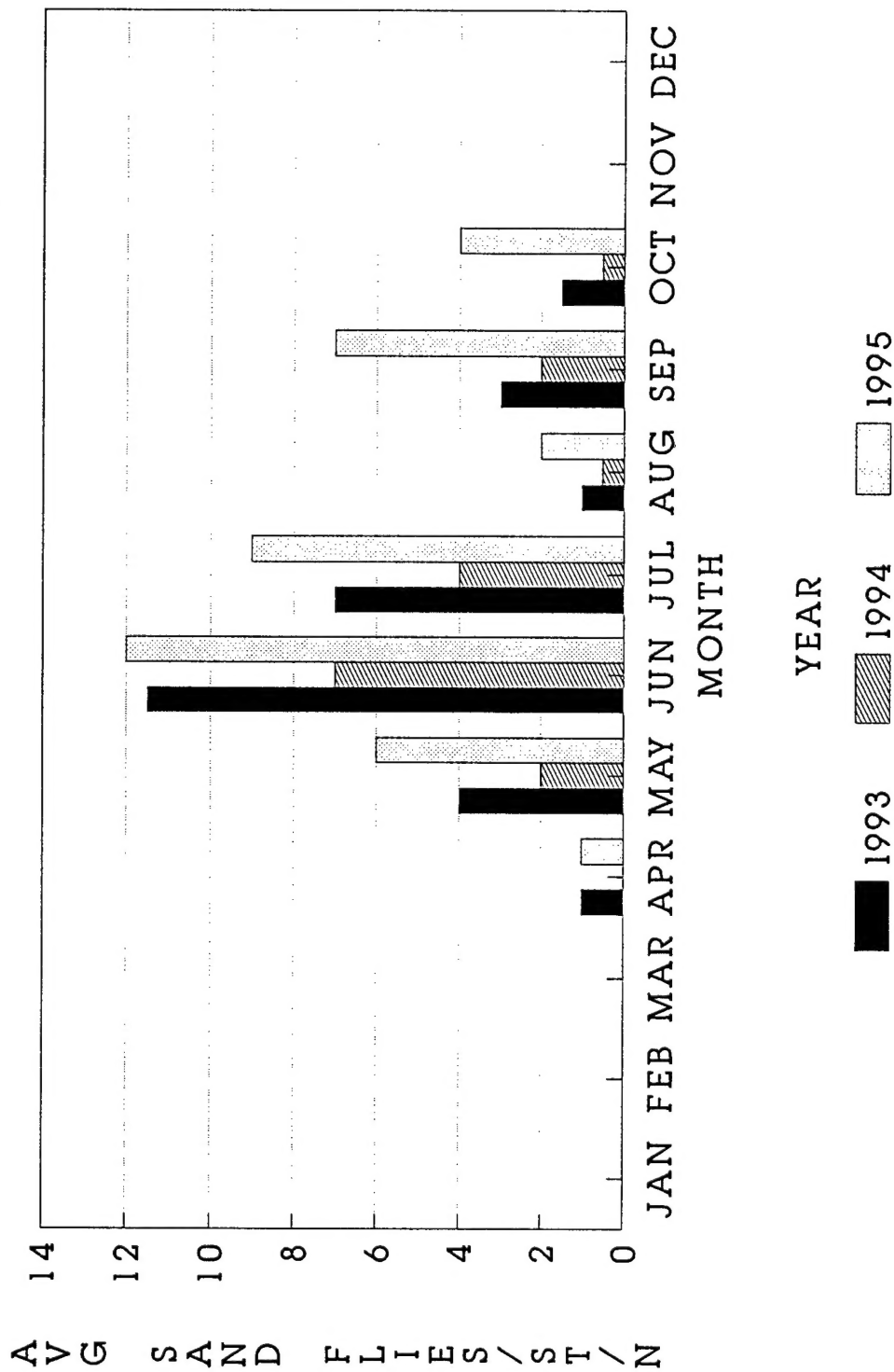
¹1 case was that of an adult U.S.N. person.

²1 case was that of an American civilian teenager.

Table 4. Percentage of Female Sand Flies Found to be Positive for Leishmania Parasites, Collected in the MFO Areas, Sinai, Egypt, 1989-1991 and 1993-1995

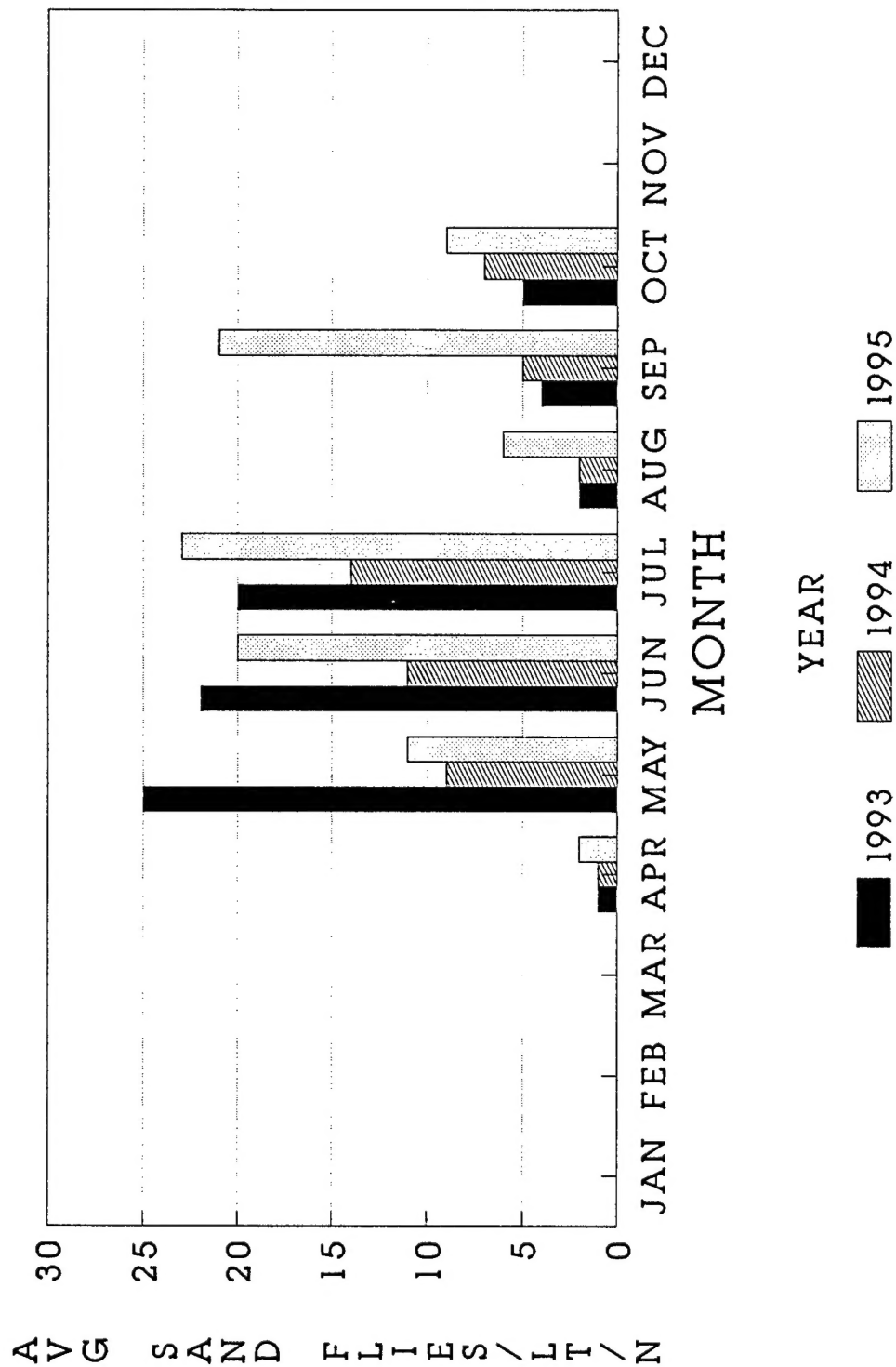
| Year | % Infected |
|------|----------------|
| 1989 | 0.69 |
| 1990 | 0.93 |
| 1991 | 0.00 |
| 1992 | No collections |
| 1993 | 1.38 |
| 1994 | 0.56 |
| 1995 | 5.07 |

Figure 1. Average Sand Flies/ST Trap/N
All Sites, Sinai, Egypt, 1993-1995



NORTHERN MFO SITES

Figure 2. Average Sand Flies/LT Trap/N
All Sites, Sinai, Egypt, 1993-1995



NORTHERN MFO SITES

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